

1 Improvement to lead sheet materials

2

3 The present invention relates to a sealant for lead
4 materials and articles, and in particular to a sealant
5 for lead materials used in the construction industry,
6 such as a flashing material or roof covering comprising a
7 lead layer. The invention also relates to lead materials
8 and articles to which the sealant is applied.

9

10 Flashing materials are used in the construction industry
11 to protect the building or structure from moisture
12 penetration. Flashing materials are often provided
13 between building components or over joins and seams to
14 divert water flow. Typically, flashing materials are
15 used around windows, doors and openings and on roofing
16 valleys and ridges. Flashings also appear between
17 buildings as gutters, and in many cases form the beds of
18 wide guttering channels.

19

20 Flashings generally comprise sheet materials, which may
21 be cut and formed into the required shape in situ. Pre-
22 formed flashings are also produced in standard shapes for
23 use in areas with known dimensions. The flashing will

1 however require working and forming around and into the
2 area to which it is fitted, and is therefore required to
3 be pliable, malleable and of sufficient thickness to
4 prevent any cracks or defects produced during the forming
5 process from impairing the waterproofing effect. Similar
6 sheet materials, although generally larger in scale, are
7 used for roof coverings themselves, typically on flat or
8 low-pitch roofs.

9
10 Lead is traditionally used for flashing and roofing
11 materials due to its deformability, resistance to damage,
12 and relative longevity. In order to provide the lead
13 with further protection, coatings have been suggested for
14 the covering exposed surfaces of the lead. Particular
15 problems with the use of lead include tarnishing of the
16 lead and other nearby surfaces, and the toxicity of the
17 lead and its alloys giving rise to an environmental and
18 ecological risk in its use. Run-off from lead itself or
19 its oxides can ultimately result in the erosion of the
20 lead sheet to an inadequate thickness. Each of the above
21 drawbacks is exacerbated by the prevalence of acid rain
22 in many areas.

23
24 US 4966819 and EP 0038222 disclose lead materials
25 provided with aluminium layers for providing
26 environmental protection and improved aesthetic effects.
27 The use of an aluminium layer significantly increases the
28 cost of the materials and significantly increases the
29 manufacturing costs of the flashing material.
30 Furthermore, the aluminium foils cannot be applied
31 retroactively to lead flashings in situ, and additional
32 coating materials such as lacquers, paints or anodisation
33 are often required to prevent corrosion of the aluminium.

1

2 It would therefore be desirable to obviate or at least
3 mitigate some of the drawbacks associated with the prior
4 art.

5

6 It is therefore an object of one aspect of the invention
7 to provide a cost efficient coating for a lead sheet
8 material.

9

10 It is a further object of an aspect of the invention to
11 provide a coating for a lead sheet material that may be
12 applied retroactively.

13

14 Other aims and objects of the invention will become
15 apparent from a reading of the following description.

16

17 According to a first aspect of the present invention
18 there is provided sheet material comprising a lead layer
19 and a leach-preventative coating, wherein the leach-
20 preventative coating comprises an ultra-violet (UV) cured
21 non-brittle solid film layer.

22

23 The leach-preventative coating may comprise an acrylic
24 based polymer.

25

26 The leach-preventative coating may comprise an epoxy
27 based polymer.

28

29 The leach-preventative coating may comprise a mixture of
30 an acrylic based polymer and an epoxy based polymer.

31

32 Preferably, the leach-preventative coating comprises a
33 material having a softness greater than that of lead.

1

2 The leach-preventative coating may comprise
3 polytetrafluoroethylene (PTFE).

4

5 The leach-preventative coating may comprise molybdenum
6 disulphide.

7

8 PTFE or molybdenum disulphide may be present in 0.1 % to
9 2 % dry weight on dry polymer.

10

11 The leach-preventative coating may have a thickness of up
12 to 300 microns.

13

14 The leach-preventative coating further comprises a
15 photoinitiator for the initiation of a radical chain
16 reaction.

17

18 The photoinitiator may be of the cationic photoinitiator
19 type such as but not limited to; diazonium salts,
20 diaryliodine salts, triarylsulphonium salts, ferrocenium
21 salts, dialkylphenacylsulphonium salts,
22 sulphonyloxyketones or silylbenzylethers.

23

24 The photoinitiator may be of the radical photoinitiator
25 type such as but not limited to; alkylarylketones
26 (acetophenone, benzophenone and derivatives thereof),
27 diarylketones, benzoin, benzoin ethers, benzoin ketals,
28 benzil ketals, acylphosphine oxide, thioxanthenes and
29 titanocenes.

30

31 The leach-preventative coating may further comprise an
32 abhorrent material for deterring pests from attacking
33 said leach-preventative coating.

1

2 The abhorrent material may include chilli or chilli
3 pepper. The abhorrent material may include extract of
4 habanero pepper.

5

6 According to a second aspect of the present invention
7 there is provided a roofing material comprising the sheet
8 material of the first aspect.

9

10 According to a third aspect of the present invention
11 there is provided a flashing comprising the sheet
12 material of the first aspect.

13

14 According to a fourth aspect of the present invention
15 there is provided a leach-preventative coating for a
16 sheet material having a lead layer, wherein the leach-
17 preventative coating comprises a non-brittle solid film
18 layer.

19

20 The leach-preventative coating may comprise a material
21 having a softness greater than that of lead.

22

23 The leach-preventative coating may comprise an acrylic
24 based polymer.

25

26 The leach-preventative coating may comprise an epoxy
27 based polymer.

28

29 The leach-preventative layer may comprise a mixture of an
30 acrylic based polymer and an epoxy based polymer.

31

32 The leach-preventative coating may comprise a solid film
33 lubricant.

1

2 The leach-preventative coating may comprise
3 polytetrafluoroethylene (PTFE).

4

5 The leach-preventative may comprise molybdenum
6 disulphide.

7

8 PTFE or molybdenum disulphide may be present in 0.1 % to
9 2 % dry weight on dry polymer.

10

11 The leach-preventative coating may have a thickness of up
12 to 300 microns.

13

14 The leach-preventative coating may comprise an abhorrent
15 material for deterring pests from attacking said leach-
16 preventative coating.

17

18 The abhorrent material may include chilli or chilli
19 pepper.

20

21 The abhorrent material may include extract of habanero
22 pepper.

23

24 According to a fifth aspect of the present invention
25 there is provided a method of preventing leaching of a
26 flashing material having a lead layer, the method
27 comprising the steps of applying an ultra-violet curable
28 coating having a non-brittle solid film layer to a lead
29 base layer, and UV curing the applied coating.

30

31 The coating may comprise a polymer.

32

33 The coating may comprise a solid film lubricant layer.

1

2 The coating may be applied by a dipping process.

3

4 The coating may be applied by a spraying process.

5

6 The coating may be applied by a barrel process.

7

8 The coating may be applied by a brushing process.

9

10 The UV light may be supplied by any suitable light source
11 including sunlight or any suitable lamp.

12

13 The lamp may be a mercury arc lamp.

14

15 The UV light may be supplied by a source restricted to
16 wavelengths between 200 nanometres and 320 nanometres.

17

18 The lead base layer may be part of a construction or
19 building.

20

21 According to a sixth aspect of the present invention
22 there is provided a sheet material comprising a lead
23 layer and a leach-preventative coating, wherein the
24 leach-preventative coating comprises a solid film layer
25 and an abhorrent material for deterring pests from
26 attacking said leach-preventative coating.

27

28 According to a seventh aspect of the present invention
29 there is provided a leach-preventative coating for a
30 sheet material having a lead layer, wherein the leach-
31 preventative coating comprises a solid film layer and an
32 abhorrent material for deterring pests from attacking
33 said leach-preventative coating.

1

2 According to a eighth aspect of the present invention
3 there is provided a method of preventing leaching of a
4 flashing material having a lead layer, the method
5 comprising the step of applying a coating to a lead base
6 layer, the coating having a solid film layer and an
7 abhorrent material for deterring pests from attacking
8 said leach-preventative coating.

9

10 According to a ninth aspect of the present invention
11 there is provided a sheet material comprising a lead
12 layer and a leach-preventative coating, wherein the
13 leach-preventative coating comprises a UV cured non-
14 brittle polymer layer.

15

16 An embodiment of the present invention will now be
17 described, by way of example only, with reference to the
18 following drawings, of which:

19

20 Figure 1 is a perspective view of a pre-formed
21 flashing material according to an embodiment of the
22 present invention;

23

24 Figure 2a shows a cross-sectional view of an example
25 application of a lead sheet material and coating as
26 a flashing;

27

28 Figure 2b shows a cross-sectional view of an example
29 application of a retroactively applied coating.

30

31 According to Figure 1, there is shown a flashing material
32 in sheet form, generally depicted at 10. The flashing
33 material comprises a lead layer 12 and a leach-

1 preventative coating 14. The leach-preventative coating
2 14 comprises a layer of a solid film lubricant. Solid
3 film lubricants are suitable since they are non-toxic and
4 inert.

5
6 In this example, the leach-preventative coating 14
7 comprises a mixture of an acrylic-based polymer and an
8 epoxy-based polymer, and is cured exposure to ultraviolet
9 (UV) light. The leach-preventative coating 14 has a
10 thickness of up to approximately 300 microns. In this
11 example, the leach-preventative coating 14 contains
12 Polytetrafluoroethylene (PTFE) in a quantity of 0.1 % to
13 2 % dry weight on dry polymer to reduce scratching and
14 abrasion. Molybdenum disulphide may be present in
15 similar quantities as an alternative to PTFE.

16
17 The solid film lubricant is non-brittle, and is selected
18 as having a softness greater than that of the lead layer.
19 The layer is thus resiliently deformable, which allows
20 the flashing material to be worked and formed into the
21 required shape at the building construction without the
22 coating cracking or flaking away from the lead layer.
23 The degree of malleability required depends on the
24 properties of the base layer itself. The relative
25 proportions of acrylic and epoxy based polymers are
26 selected in order to get an appropriate hardness and
27 malleability of the resulting layer.

28
29 Although a material softer than lead is preferred, a
30 material with a comparable softness, or even a slightly
31 harder material would also suitable.

32

1 The leach-preventative coating 14 is blended with an
2 abhorrent material for deterring pests from attacking the
3 coating. The abhorrent is, in this example, extract of
4 habanero pepper. The abhorrent is provided because the
5 solid film layers used to coat the lead sheet are be
6 subject to attack by various pests during manufacture and
7 when fitted on exposed structures. Such pests include
8 small mammals such as rats, mice, and squirrels, as well
9 as invertebrate species such as roaches, termites,
10 spiders, ants, and other insects. These species are
11 liable to attack the coating on the lead layer, causing
12 defect to it and re-exposing the lead layer to the
13 environment. Attack by pests in sufficient quantities
14 would negate the effect of a coating, and the lead layer
15 would then be liable to leach into the environment after
16 installation.

17
18 The leach-preventative coating 14 is blended with a
19 photoinitiator for the initiation of a radical chain
20 reaction, in order to facilitates the polymerisation
21 process (described in more detail below).

22
23 The photoinitiator may be of the cationic photoinitiator
24 type such as (but not limited to): diazonium salts,
25 diaryliodinium salts, triarylsulphonium salts, ferrocenium
26 salts, dialkylphenacylsulphonium salts,
27 sulphonyloxyketones or silylbenzylethers.

28
29 The photoinitiator may be of the radical photoinitiator
30 type such as (but not limited to): alkylarylketones
31 (acetophenone, benzophenone and derivatives thereof),
32 diarylketones, benzoine, benzoine ethers, benzoineketals,

1 benzilketals, acylphosphine oxide, thioxanthenes and
2 titanocenes.

3
4 A variety of known techniques are suitable for applying
5 the solid film layer to the lead base layer. These
6 include spraying, immersion (including dip-drain and dip-
7 spin), curtain coating, electrophoresis, roller coating,
8 printing, and application by brush. During storage and
9 application of the coating, the formulation is protected
10 from direct sunlight in order to prevent undesired
11 polymerisation.

12
13 The coating is subsequently cured by UV curing.

14
15 The presence of a photoinitiator begins a radical chain
16 reaction, although once commenced the polymerisation may
17 proceed without any further contribution from the
18 photoinitiator. The curing may take place in an inert
19 atmosphere, or a low oxygen atmosphere in order to
20 mitigate the effects of ambient oxygen on the un-
21 saturated bonds in the curable polymer which can result
22 in longer curing time or insufficient curing. Typically,
23 the reaction may tolerate an oxygen content of up to 3%.
24 However, higher oxygen levels can be accounted for by
25 adjusting the quantities or type of photoinitiator in the
26 mixture.

27
28 Specifically, UV radical photoinitiators may be used in
29 an inert atmosphere, and UV cationic photoinitiators may
30 be used in an inert or oxygen-containing atmosphere.

31
32 The UV light may be supplied by any suitable light source
33 emitting UV light, such as a mercury arc lamp. For

1 example, the light source may be a lamp restricted to
2 wavelengths between 200 nanometres and 320 nanometres.

3
4 In alternative embodiments, the light source may be a
5 lamp that emits light with wavelengths between 200
6 nanometres and 1.3 micrometres incorporating UV light,
7 visible light and infrared light. Filters are used to
8 prevent the UV light from exposing the environment around
9 the reaction chamber.

10
11 In some cases, the coating may also be provided with UV
12 absorbers to increase the sunlight resistance of the
13 coating. During curing, these UV absorbers will compete
14 with the polymerisation process to reduce the curing
15 effects, but can be compensated for by longer curing time
16 or by including compensatory photoinitiators.

17
18 It is possible to combine the abhorrent material into the
19 coating layer before or after the layer has been applied
20 to the lead base layer. For example, the abhorrent could
21 be mixed with the coating material prior to coating and
22 curing. Alternatively, the abhorrent could be sprayed or
23 scattered on the coating layer after it has been applied
24 but before curing.

25
26 Figure 2a shows a typical application of an embodiment of
27 the present invention. Figure 2a shows a structure,
28 generally depicted at 20, comprising roofing members 21,
29 and an exposed planar member 22. The exposed planar
30 member 22 is for example a roofing tile fitted to the
31 structure 20.

32

1 Also fitted to the structure is a flashing 24,
2 retrofitted to the structure 20 to improve waterproofing.
3 The flashing 24 is a pre-formed sheet of flashing
4 material as shown in Figure 1, having a base lead layer
5 26 and a leach-preventative coating 25. The leach-
6 preventative coating is a UV-cured polymer blended with
7 an abhorrent for deterring pests. The flashing 24 is
8 fitted such that it partially overlaps the tile 22.
9
10 At the seam 23, the two flashings are joined to one
11 another by techniques known in the art. Subsequently, a
12 layer 27 of the leach-preventative coating material is
13 provided over the seam 23 to cover the exposed edge of
14 the lead layer. The layer 27 is a thermoset polymer
15 material blended with an abhorrent, such as extract of
16 habanero pepper, and is applied to the seam 23 by
17 spraying. When cured, the layer 27 forms a leach-
18 preventative layer over the seam 23.
19
20 The coating 27 could alternatively be applied over the
21 surface of the exposed planar member 22. For instance,
22 if the planar member 22 is an existing lead flashing, the
23 coating may be required over its entire exposed surface
24 to prevent leaching and oxidising.
25
26 The coating of the present invention can equally be
27 applied to soldered or welded regions of lead flashings.
28 Figure 2b shows an example of a structure, generally
29 depicted at 30, to which a flashing layer 24 has been
30 applied. The flashing layer 24 is of the type shown in
31 Figure 1, and comprises a lead base layer 26 and a leach-
32 preventative coating 25. As before, the leach-

1 preventative coating 25 is optionally provided with an
2 abhorrent material.

3

4 The flashing 24 is secured to a roofing member by a screw
5 32 extending through the flashing sheet material and into
6 the roofing member. The screw head is then provided with
7 a lead covering 33, to prevent water penetration via the
8 screw bore. The seal is made by soldering or welding the
9 lead layer to the flashing 24. This application of heat
10 causes damage to the leach-preventative coating 25, and
11 results in an area of the lead base layer 26 surrounding
12 the screw head to be exposed. A supplementary layer 34
13 of the leach-preventative coating is therefore provided
14 over the lead layer 33.

15

16 In an alternative arrangement to that shown in Figure 2b,
17 the lead sheet material may be folded over and around the
18 screw head, to avoid or reduce the requirement for
19 soldering. The coating layer can be applied in the same
20 way to prevent exposure of the lead to the environment.

21

22 It will be appreciated that the coating layer of the
23 present invention has numerous applications in connection
24 with flashings, roofing, and lead sheet materials.

25

26 For example, the lead sheet materials used in
27 constructing flashings can be pre-formed with the leach-
28 preventative coating, in the manner described with
29 reference to Figure 1. These pre-formed sheets can then
30 be used for flashings for new construction projects, or
31 retrofitted on pre-existing structures.

32

1 In addition, the nature of the coating allows is to be
2 retrofitted to flashings in situ. This maybe, for
3 example, at particular seams or joins in existing
4 flashing materials, or over the entire roof or exposed
5 surface of lead materials present on structures.

6
7 Furthermore, any new application of lead to existing
8 structures, such as in patch repairs or soldering and
9 welding operations may be coated with the leach
10 preventative coating according to the present invention.
11 This also applies to operations and activities that cause
12 re-exposure of lead that has been previously coated with
13 any coating material.

14
15 The arrangements shown in Figures 2a and 2b are exemplary
16 only, and it will be apparent that many other
17 applications of the sheeting material exist. For
18 example, the lead sheet materials can be used for forming
19 the base and sidewalls of a guttering channel.

20
21 Various modifications and changes could be made to the
22 described embodiments within the scope of the claims.
23 For example, the abhorrent material could be any natural
24 or synthetic material or additive having a taste, odour
25 or flavour repellent to pests. Examples include spices,
26 oils, chemicals, clove oil and soap.

27
28 The present invention provides an improved lead sheeting
29 material that is cost efficient and flexible in its
30 application.